

108TH CONGRESS
2D SESSION

S. 2176

To require the Secretary of Energy to carry out a program of research and development to advance high-end computing.

IN THE SENATE OF THE UNITED STATES

MARCH 8, 2004

Mr. BINGAMAN (for himself and Mr. ALEXANDER) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

A BILL

To require the Secretary of Energy to carry out a program of research and development to advance high-end computing.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “High-End Computing
5 Revitalization Act of 2004”.

6 **SEC. 2. FINDINGS.**

7 Congress finds that—

8 (1) high-end computing is a critical component
9 of the scientific advances, defense capabilities, and

1 commercial competitiveness of the United States in
2 the 21st century;

3 (2) with the deployment of the Earth System
4 Simulator in Japan, the United States no longer has
5 a clear lead in high-end computing worldwide;

6 (3)(A) promising new architectures should be
7 developed that increase memory and network band-
8 width, minimize latency, and coordinate the architec-
9 tures' various components to maximize application
10 performance; and

11 (B) it is recognized that different architectures
12 may be better suited to different applications;

13 (4)(A) software that improves efficiency on and
14 accessibility to high-end systems should be devel-
15 oped; and

16 (B) this development effort should include re-
17 search in optimal algorithms, programming environ-
18 ments, tools, languages, and operating systems for
19 high-end computing, in collaboration with architec-
20 ture development efforts;

21 (5) without government support, market forces
22 are unlikely to drive sufficient innovation in high-
23 end computing, because the private sector would not
24 capture the full value of its innovations on a short
25 enough time frame; and

(6) having played an important role in the development of high-end computing, networking, and information technology, the Department of Energy, and the research programs of the Office of Science of the Department, are particularly qualified to lead research in those fields.

SEC. 3. DEFINITIONS.

In this Act:

(1) HIGH-END COMPUTING SYSTEM.—

(A) IN GENERAL.—The term “high-end computing system” means a computing system with performance that substantially exceeds commonly available systems.

(B) INCLUSIONS.—The term “high-end computing system” includes a system described in subparagraph (A) that is based on a variety of architectures, including vector, reconfigurable logic, streaming, processor-in-memory, and multithreading architectures.

(2) INSTITUTION OF HIGHER EDUCATION.—The term “institution of higher education” has the meaning given the term in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)).

(3) SECRETARY.—The term “Secretary” means the Secretary of Energy, acting through the Director

1 of the Office of Science of the Department of En-
 2 ergy.

3 (4) ULTRASCALE SCIENTIFIC COMPUTING CAPA-
 4 BILITY.—The term “ultrascale scientific computing
 5 capability” means a computing capability supporting
 6 open scientific research in the United States that is
 7 at least 100 times such computing capability in ex-
 8 istence on the date of enactment of this Act.

9 **SEC. 4. HIGH-END COMPUTING SYSTEMS PROGRAM.**

10 (a) IN GENERAL.—In addition to any other authority
 11 provided by law, the Secretary shall carry out a program
 12 of research and development (involving software and hard-
 13 ware) to advance high-end computing systems.

14 (b) DUTIES.—In carrying out the program, the Sec-
 15 retary shall—

16 (1) support both individual investigators and
 17 multidisciplinary teams of investigators;

18 (2) conduct research in multiple architectures,
 19 including vector, reconfigurable logic, streaming,
 20 processor-in-memory, and multithreading architec-
 21 tures;

22 (3) conduct research in software development
 23 on optimal algorithms, programming environments,
 24 tools, languages, and operating systems for high-end

1 computing systems, in collaboration with architec-
2 ture development efforts;

3 (4) in accordance with subsection (c), develop,
4 plan, construct, acquire, or operate equipment or fa-
5 cilities for the use of investigators conducting re-
6 search and development on an ultrascale scientific
7 computing capability;

8 (5) support technology transfer to the private
9 sector and others in accordance with applicable law;
10 and

11 (6) ensure that the program is coordinated with
12 relevant activities in industry and other Federal
13 agencies, including the National Nuclear Security
14 Administration, the National Science Foundation,
15 the Defense Advanced Research Projects Agency,
16 and the National Security Agency.

17 (c) ULTRASCALE SCIENTIFIC COMPUTING CAPA-
18 BILITY.—

19 (1) IN GENERAL.—As part of the program car-
20 ried out under this Act, the Secretary shall develop,
21 plan, construct, acquire, or operate a coordinated set
22 of facilities for investigators to develop an ultrascale
23 scientific computing capability for—

24 (A) scientific research and development
25 using high-end computing systems; and

1 (B) developing potential advancements in
 2 high-end computing system architecture and
 3 software.

4 (2) ADMINISTRATION.—In carrying out this
 5 subsection, the Secretary shall—

6 (A) support multiple high-end computing
 7 system architectures; and

8 (B) conduct research on the basis of pro-
 9 posals (including proposals that are submitted
 10 by industry, institutions of higher education,
 11 national laboratories, or any Federal agency)
 12 for research on problems that would particu-
 13 larly benefit from large computing power, even
 14 as the reliability of new hardware and software
 15 components are being evaluated.

16 (d) HIGH-END SOFTWARE DEVELOPMENT CEN-
 17 TER.—

18 (1) IN GENERAL.—As part of the program car-
 19 ried out under this Act, the Secretary shall develop,
 20 plan, construct, acquire, or operate at least 1 High-
 21 End Software Development Center.

22 (2) DUTIES.—A Center shall concentrate ef-
 23 forts to develop, test, maintain, and support optimal
 24 algorithms, programming environments, tools, lan-

1 guages, and operating systems for high-end com-
2 puting systems.

3 (3) STAFF.—A Center shall include—

4 (A) a regular research staff, to create a
5 centralized knowledge-base for high-end soft-
6 ware development; and

7 (B) a rotating staff of researchers from
8 other institutions and industry to assist in the
9 coordination of research efforts and promote
10 technology transfer to the private sector.

11 (4) USE OF EXPERTISE.—The Secretary shall
12 use the expertise of a Center to assess research and
13 development in high-end computing system architec-
14 ture.

15 (5) LOCATION.—The location of a Center shall
16 be determined by a competitive proposal process ad-
17 ministered by the Secretary.

18 (e) PEER REVIEW.—Each grant, contract, coopera-
19 tive agreement, and financial assistance awarded under
20 this section shall be made only after independent peer re-
21 view.

22 (f) CLASSIFIED RESEARCH OR FACILITIES.—No
23 funds under this section may be used to directly support
24 classified research or facilities.

1 **SEC. 5. AUTHORIZATION OF APPROPRIATIONS.**

2 (a) IN GENERAL.—In addition to amounts made
3 available for high-end computing systems under other pro-
4 visions of law, there are authorized to be appropriated to
5 the Secretary to carry out this Act—

6 (1) \$150,000,000 for fiscal year 2005;

7 (2) \$155,000,000 for fiscal year 2006;

8 (3) \$160,000,000 for fiscal year 2007;

9 (4) \$165,000,000 for fiscal year 2008; and

10 (5) \$170,000,000 for fiscal year 2009.

11 (b) ULTRASCALE SCIENTIFIC COMPUTING CAPA-
12 BILITY.—Of the funds made available under subsection
13 (a), \$100,000,000 is authorized to be appropriated for
14 each fiscal year to carry out section 4(c).

15 (c) HIGH-END SOFTWARE DEVELOPMENT CEN-
16 TER.—Of the funds made available under subsection (a),
17 \$10,000,000 is authorized to be appropriated for each fis-
18 cal year to carry out section 4(d).

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